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(54) Process for separating and recovering lead, rubber and copper wires from waste cables.

(57) The present invention relates to a process for separating and recovering copper wires, lead granules and rubber grains coming from waste cables, through washing, gravimetric separation, screening operations and methods for flattening the lead grains.

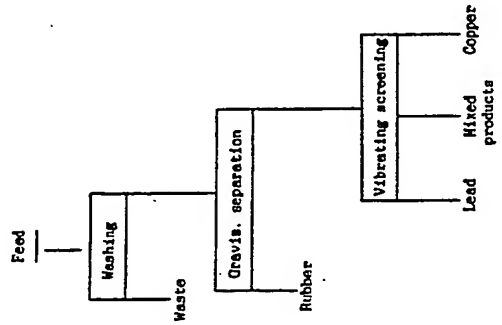

FIG.1

EP 0 431 582 A1

PROCESS FOR SEPARATING AND RECOVERING LEAD, RUBBER AND COPPER WIRES FROM WASTE CABLES.

Prior Art

The recovery and the separation of the waste cable components with economically interesting contents and yields is a problem of world-wide importance in view of the possibility which would be offered, once an effective recovery method should be available, to re-utilize great amounts of valuable materials and also in consideration of the pollution problems connected with a possible dispersion of such materials.

Thus, the object of the present invention is a process which permits a separation of the individual valuable components of the waste cables (i.e. copper, lead and rubber) from the accessory waste elements, such as paper, textile threads, and the recovery of said components.

Detailed Description of the Invention

The process for the separation and the recovery of rubber, lead and copper wires from waste cables according to the present invention is characterized in that it comprises in whole or in part the following characteristic steps of:

a) washing in a water stream the material to be separated in order to remove the lighter polluting elements,

b) treating the residual product with a thick medium from which the rubbers are separated as a light fraction,

c) subjecting the heavy fraction to screening by means of shaking-vibrationvibrating screens, thereby obtaining copper, lead and mixed products,

d) subjecting the fine granulometry mixed products to the action of a ball mill and then to a further screening.

As one can notice, in consideration of the particular nature and dimensions of the materials to be recovered, an essentially mechanical separation technique has been chosen, the general scheme thereof is shown in figure 1.

According to said scheme, the cloth and the other light waste materials are separated by washing in a water stream.

The product remained after washing consists of copper, lead and rubber. The separation of these components is carried out using a thick medium, which preferably consists of water and calcium chloride, the density being equal to 1.1 - 1.6 kg/l.

Two fractions are so obtained, one fraction having a lower density than the one of the medium and consisting of rubbers, while the other fraction has a higher density and consists of the copper wires and of the lead grains. Due to the great difference of density existing between the rubbers and the metals, the separation efficiency is very high with recovery yields higher than 95%.

The separation of the copper wires from the lead grains - in the case of components having a coarse granulometry (4 - 10 mm) - has been obtained by screening, by accurately selecting the screen mesh size and the type of movement of the screen, which must be of the shaking vibratory type with an amplitude of the vertical movement varying from 0.5 to 30 mm.

The movement amplitude and intensity depend, of course, on the grain size. On conclusion of this operation, the undersize will be substantially composed of copper wires, while the oversize will be composed of lead grains. Since a part of the copper wires remains entrapped in the screen meshes, it is necessary to carry out a second screening with overturned screen so as to recover all the copper wires and at the same time to clean the screen.

In the case of components having a fine granulometry (below 4 mm), the separation is obtained by means of two different types of classification and by means of a process for flattening the lead grains. The mix components are divided into narrow classes by using elliptical vibration screens. Each class is subjected to a lead grains flattening process using a ball-mill. By this process, by virtue of the different ductility of the two metals considered, a diversification of the particle shape is obtained. In fact, the copper wires retain their original shape, while the lead particles are strongly flattened until becoming nearly laminar. Thereafter, the separation by means of a shaking-vibration screen is carried out, as described hereinbefore.

The separation process steps schematically indicated before can be carried out in whole or in part, depending on the specific composition of the material mixture to be treated.

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Experimental part

The process according to the present invention was applicated to 5 samples, four of which were consisting of rubber, lead and copper wires having a granulometry of 4 - 10 mm (coarse granulometry) and one consisting of lead grains and copper wires having a lower granulometry (fine granulometry).

Coarse granulometry samples

The samples were washed in water in order to separate the very light polluting materials such as paper and cloth. The product was then treated with a medium having a density equal to 1.3 and consisting of an aqueous solution of calcium chloride. The supernatant material was composed of rubber and plastics, while the heavy fraction consisted of copper and lead. The so separated products were washed and dried. The lighter fraction represented the finished product, while the mixture of copper and lead was screened by means of vibrating screens having net mesh sizes ranging from 1.5 to 0.7 mm. The undersize consisted of copper wires, while the oversize consisted essentially of lead.

When the operation was repeated with overturned screens, an almost total recovery of the copper wires and a screen cleaning were obtained.

The process now described is schematically represented in figure 2.

Fine granulometry sample

Since in this case the sample did not contain rubbers, no separation with a thick medium was carried out.

The sample was divided into narrow granulometric classes ranging from 2 to 0.5 mm in order to obtain a higher effectiveness of the treatment.

The fraction above 2 mm constituted a mixed product, while the fraction below 0.5 mm was to be considered as a finished lead product.

The other granulometric classes: -2 + 1.7 mm; -1.7 + 1.4 mm; -1.4 + 1 mm; -1 + 0.5 mm were separated by means of suitable vibrating screens with treatment times of about 15 minutes.

Products prevailingly consisting of copper or lead and mixed products were so obtained. The mixed products were treated in a ball mill for about 20 minutes and were then subjected again to screening, still obtaining a copper product, a lead product and mixed products. The process can be repeated depending on the necessity and convenience. The mixed products will finally consist of copper wires entrapped by a rubber coating and of copper wires and lead grains, the shape differences of which are very slight; said mixed products can be recycled.

The process now described is shematically represented in figure 3. Tables I and II show the values relating to the recovery of Cu and of Pb in the coarse grain samples and in the fine grain samples, respectively. The copper product content is expressed as:

Cu % in the product / Cu % in the copper wire

The relative content of the lead product is given by:

(1 - Rel. Cont. of copper product) %.

As is inferable from the indicated data, the process permits a very effective recovery by means of a method easy to be practised.

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Table I - Balance of the coarse granulometry sample tests

Product name	Weight	Content %		Rel. Cont. %		Rel. Recovery %	
		Cu	Pb	Copper	Lead	Copper	Lead
Copper	60.22	90.02	9.98	91.91	8.09	92.88	12.06
Pd 1	12.77	6.30	93.70	6.43	93.57	1.38	29.57
Pb 2	27.01	12.44	87.56	12.70	87.30	5.74	58.37
Feed	100.0	58.37	41.63	59.59	40.41	100.0	100.0

Table II - Balance of the fine granulometry sample test

Product name	Weight %	Content %		Rel. Cont. %		Rel. Recovery %	
		Cu	Pb	Copper	Lead	Copper	Lead
Copper	28.25	87.86	12.14	87.81	10.29	59.21	5.08
Lead	39.30	14.2	85.80	14.50	85.50	13.31	58.74
Mixed Products	32.48	35.51	64.49	36.27	63.73	27.48	36.18
Feed	100.0	41.92	58.08	42.80	57.20	100.0	100.0

Claims

1. A process for separating and recovering rubber, lead and copper wires from waste cables, comprising in whole or in part the following steps of:
   a) washing in a water stream the material to be separated in order to remove the lighter polluting elements,
   b) treating the residual product with a thick medium, from which the rubber are separated as a light fraction,
   c) subjecting the heavy fraction to screening by means of shaking-vibration vibrating screens, thereby obtaining copper, lead and mixed products,
   d) subjecting the fine granulometry mixed products to the action of a ball mill and then to a further screening.

2. The process according to claim 1, wherein the thick medium has a density ranging from 1.1 to 1.6 kg/liter.

3. The process according to claim 1, wherein the thick medium consists of a solution of calcium chloride in water having a density ranging from 1.1 to 1.6 kg/liter.

4. The process according to claim 1, wherein the vibrating screens exhibit net mesh sizes ranging from

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1.5 to 0.7 mm.

5. The process according to claim 1, wherein the mixed products consisting of products having particle sizes below 4 mm are divided into narrow classes and are then subjected to the action of a ball mill, which permits the flattening of the lead granules, and subsequently are subjected again to screening.

6. The process according to claim 5, wherein the narrow classes are in the range of from 2 to 0.5 mm.

7. The process according to claim 6, wherein the classes are represented by -2 + 1.7 mm; -1.7 + 1.4 mm; -1.4 + 1 mm; -1 + 0.5 mm.

8. Recovery products from waste cables, said products being separated according to the process as claimed in claims 1 to 6.

CLAIMS FOR THE FOLLOWING CONTRACTING STATES: GR AND ES

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   a) washing in a water stream the material to be separated in order to remove the lighter polluting elements,
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FIG.1

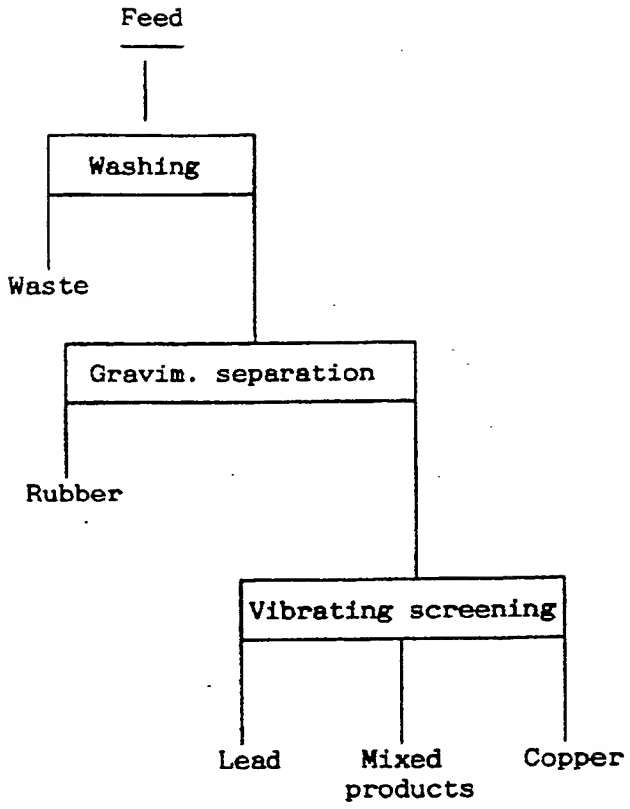

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FIG. 2

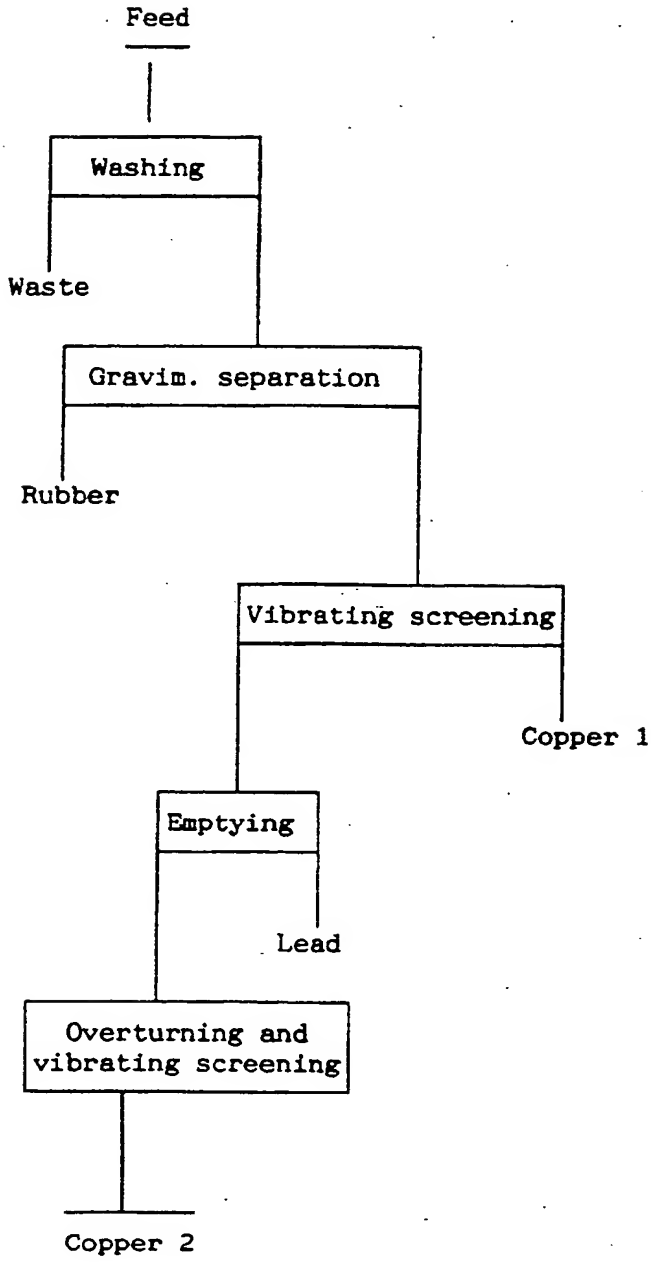

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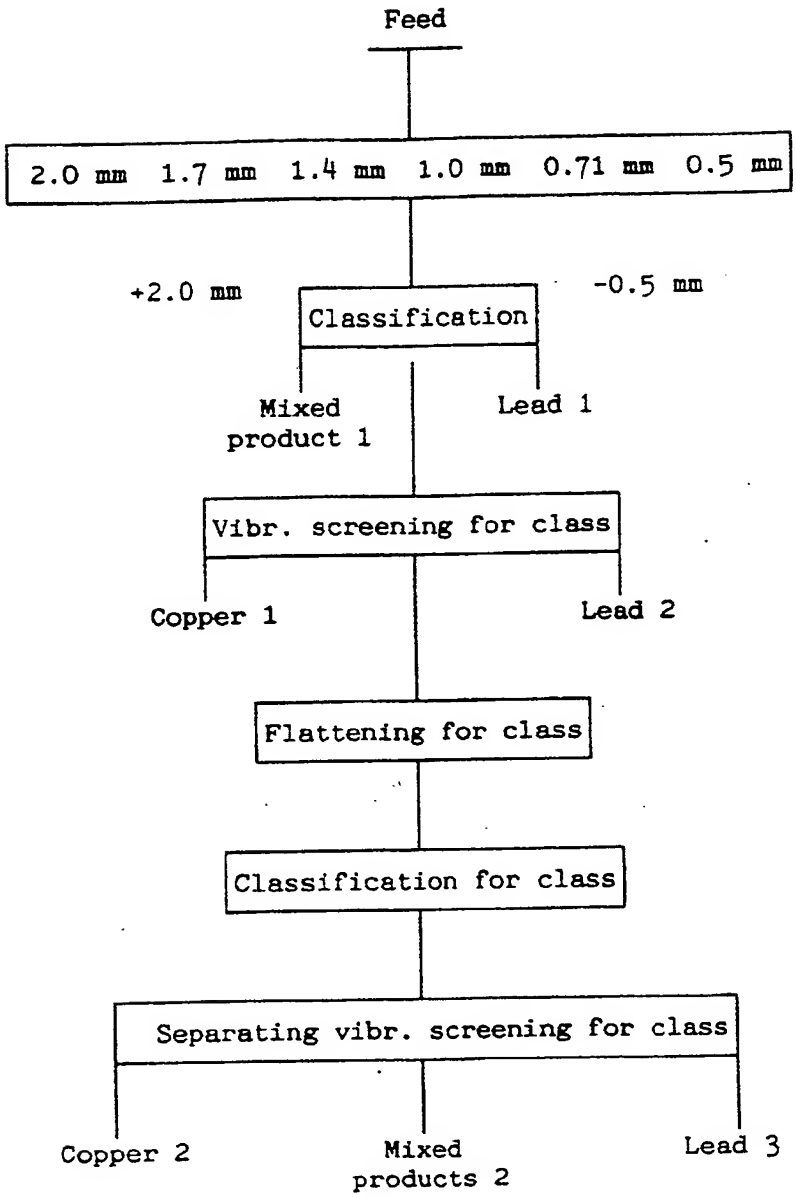
FIG. 3



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 12 3296

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 582 004 (LENZ ET AL) * column 1, lines 4 - 13 * * column 2, line 29 - column 3, line 10; figures *	1,8	B 03 B 9/06 H 01 B 15/00
A	GB-A-2 146 272 (YIN-PO LIN) * page 1, lines 51 - 55 * * page 2, lines 14 - 40; figures *	1,8	
A	EP-A-0 296 791 (DESIGN COUNT PTY. LTD.) * column 6, line 16 - column 8, line 13; figures *	1,8	
A	DE-A-3 210 972 (ALU PLAST ALUMINIUM-PLASTIK RE-CYCLING GMBH) * page 16, line 1 - page 18, line 13; figures *	1-3,8	
A	GB-A-1 453 851 (BOC INTERNATIONAL LTD.)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 03 B
H 01 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	06 March 91	VAN DER ZEE W.T.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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T: theory or principle underlying the invention

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D: document cited in the application
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